## NMCP COVID-19 Report: Friday, 17 April 2020

**Prepared by:** Tracy Shields, MSIS, AHIP <tracy.c.shields2.civ@mail.mil>
Reference Medical Librarian; Naval Medical Center Portsmouth, Library Services

**Disclaimer:** I am not a medical professional. This document is current as of the date noted above. While I make every effort to find and summarize available data, things are changing rapidly, with new research and potentially conflicting literature published daily. Best practice and evidence are constantly shifting during this international public health crisis.

**Statistics (as of Friday, 17 April 2020 at 1200)**

*Global:* 2,182,734 confirmed cases, 147,384 deaths in 185 countries/regions

| *United States* | *Virginia* |
|---|---|
| UW IHME<br>Estimated peak resource use: 10 April 2020 | UW IHME<br>Estimated peak resource use: 27 April 2020 |
| JHU CSSE<br>Total confirmed cases: 672,293<br>NY: 223,691<br>NJ: 75,317<br>MA: 32,181<br>VA is ranked 18th<br>Total deaths: 33,325<br>NY: 14,832<br>NJ: 3,518<br>MA: 1,245<br>Total tested: 3,423,034<br>NY: 550,579<br>NJ: 151,830<br>MA: 140,773 | VHHA<br>Ventilators: 2,862 on hand; 622 in use (22%)<br>Bed availability: 5,587<br><br>VA DOH<br>Total cases / hospitalizations: 7,491 / 1,221<br>Chesapeake: 147 / 36<br>Hampton: 78 / 21<br>Newport News: 100 / na<br>Norfolk: 108 / 27<br>Portsmouth: 63 / 23<br>Suffolk: 70 / na<br>Virginia Beach: 265 / 57<br>Total deaths: 231<br>Total tested: 48,997 |
| Dept VA<br>Positive Cases: 5,087<br>Inpatient Deaths: 301 | Dept VA<br>Positive Cases (3 facilities): 106<br>Hampton, VA: 45<br>Inpatient Deaths (3 facilities): 4<br>Hampton, VA: 1 |

**Evidence Summary: Invasive Versus Noninvasive Ventilation**

A China-based study of COVID-19 pneumonia patients found high flow nasal cannula (HFNC) was the most common ventilation support and first line therapy, followed by noninvasive ventilation (NIV) (Ann Intensive Care). A review article summarizes the experiences of providers in Wuhan and their ventilation strategies summarizes:

> "In patients with acute refractory hypoxemic respiratory failure, timely, but not premature, intubation and invasive ventilation support may be superior to high-flow oxygen therapy and bilevel positive airway pressure ventilation in boosting transpulmonary pressure, opening collapsed alveoli, improving oxygenation, decreasing oxygen debt, and offering a better chance for the lungs to heal. The invasive nature of intubation and ventilation exposes patients to an augmented risk of procedure-related mishaps. At the same time, these procedures present healthcare providers with an enhanced risk of cross-infection; thus, strict self-protection precautions are mandatory." (Anesthesiology)

The American Association for Respiratory Care (AARC) website notes the conflict of evidence for HFNC and NIV, including positive pressure (NIPPV):

> " Some studies [Lancet Respir Med] have indicated that HFNC and NIV have not been useful in treating patients with COVID-19. Studies have shown [Pharmaceutics] that there is a potential for secondary inhalation of emissions released from the patient on HFNC. Some recommend placing these patients in negative-pressure rooms if HFNC is used. There are some recommendations from clinicians about proper ways to manage these patients in the ICU [Intensive Care Med]."

*Guidelines and Practice Recommendations*

A guidance document from AARC states:

- "For adults with COVID-19 and acute hypoxemic respiratory failure despite conventional oxygen therapy, we suggest using HFNC over conventional oxygen therapy."
- "In adults with COVID-19 and acute hypoxemic respiratory failure, we suggest using HFNC over NIPPV."
- "In adults with COVID-19 and acute hypoxemic respiratory failure, if HFNC is not available and there is no urgent indication for endotracheal intubation, we suggest a trial of NIPPV with close monitoring and short-interval assessment for worsening of respiratory failure." (AARC [guidance])

The AARC notes that they are not able to make a recommendation on using helmet versus mask NIPPV (AARC [guidance]). For more on helmet NIPPV, see this recent letter to the editor describes a "helmet bundle" (Intensive Crit Care Nurs).

The European Society of Paediatric and Neonatal Intensive Care has published practice recommendations for managing pediatric patients with suspected or proven COVID-19 (ESPNIC).

*Protocols*

Some large hospital systems have made public their internal clinical guidelines for COVID-19. Selected as relevant to this issue:

- Brigham and Women's Hospital has extensive protocols, including a section on respiratory and pulmonary that may be of particular interest; the protocol outlines management of hypoxemia, mechanical ventilation, NIPPV and HFNC, and prone ventilation (COVID-19 Protocols).
- Massachusetts General Hospital inpatient care recommendations state: "here mechanical ventilation is available, it is the preferred means of respiratory support in patients with COVID-19 associated respiratory failure… Should there be a need to employ NIPPV or HFNC in a patient with known or suspected COVID-19 these therapies should only be provided in the context of Strict Isolation" (Mass Gen [Crit Care]). They also have protocols for prone positioning for intubated (Mass Gen [int]) and non-intubated (Mass Gen [nonint]) patients.
- The University of Nebraska has protocols for ventilator use in ARDS secondary to COVID-19 (UN [vent]) and a "pronocol" for prone positioning (UN [prone]).
- The University of Washington has proposed management of COVID-19 with HFNC (UW [HFNC]) along with other protocols on a variety of topics that may be of interest in general (UW [RS]).

*Other Literature*

A 2003 review of SARS patients noted noninvasive ventilation – including BiPAP, CPAP, or nasal canula – was effective in SARS patients with acute respiratory failure (Respirology). Older, non-COVID-19 specific guidelines that may be of value include nonpharmacologic airway clearance therapies (AARC) and management of acute respiratory distress syndrome (BMJ Open Respir Res).

For a collection of other citations in PubMed that may be of interest, see: https://www.ncbi.nlm.nih.gov/sites/myncbi/tracy.shields.1/collections/59531869/public/

*Note: There are Chinese language articles that are highly relevant to this question but are not included here because the available English language abstracts may not fully represent the research.*

**Recent Literature**

ASPR: COVID-19 Hospital Resource Package

> The Assistant Secretary for Preparedness and Response has published a document with links to various resources from TRACIE specific to hospital planning needs. The document provides guidance on surge planning for the emergency department, critical care, and mortuary services; crisis standards of care; staffing surge and resilience; workforce protection; regulatory concerns; PPE and healthcare supply chains; and telemedicine.
>
> ASPR TRACIE has an extensive collection for novel coronavirus resources. See: https://asprtracie.hhs.gov/COVID-19

Am J Respir Crit Care Med: Hospital Preparedness for COVID-19: A Practical Guide from a Critical Care Perspective (16 April 2020)

> Authors from Weill Cornell Medicine describe the protocols and process initiatives for surge planning with COVID-19 patients:
>
> "We describe in granular detail, the procedures and processes developed during a one month period while surge planning was ongoing and the need for intensive care unit capacity rose exponentially. The approaches described provide a potential roadmap for centers that must rapidly adapt to the tremendous challenge introduced by this and potential future pandemics."

JAMA: Rates of Co-infection Between SARS-CoV-2 and Other Respiratory Pathogens (16 April 2020)

> A Stanford-based analysis of 1217 specimens tested for SARS-CoV-2 and other respiratory pathogens (influenza A/B, respiratory syncytial virus, non–SARS-CoV-2 Coronaviridae, adenovirus, parainfluenza 1-4, human metapneumovirus, rhinovirus/enterovirus, *Chlamydia pneumoniae*, *Mycoplasma pneumoniae*) found "116 of the 1217 specimens (9.5%) were positive for SARS-CoV-2 and 318 (26.1%) were positive for 1 or more non–SARS-CoV-2 pathogens… Of the 116 specimens positive for SARS-CoV-2, 24 (20.7%) were positive for 1 or more additional pathogens, compared with 294 of the 1101 specimens (26.7%) negative for SARS-CoV-2."

JAMA: Incorporating Test Characteristics Into SARS-CoV-2 Testing Policy—Sense and Sensitivity (15 April 2020)

> "We are in uncharted territory trying to mitigate the consequences of an unfamiliar foe affecting populations the world over. However, policy makers and leaders have the opportunity to implement thoughtful testing policies as they increase testing capacity. Information about test characteristics and yield from different sample sites is needed to balance diagnostic benefit and clinician safety and to form the basis for testing policies that can help us most effectively respond to the COVID-19 pandemic."

Lancet Psychiatry: Multidisciplinary research priorities for the COVID-19 pandemic: a call for action for mental health science (15 April 2020)

> This position paper calls for research efforts in mental health focusing on the COVID-19 pandemic, touching on immediate actions as well as long-term strategies.

Nature: Temporal dynamics in viral shedding and transmissibility of COVID-19 (15 April 2020)

> China-based analysis of COVID-19 cases to look at viral loads at different times. "Our analysis suggests that viral shedding may begin 2 to 3 days before the appearance of the first symptoms."

Science: Projecting the transmission dynamics of SARS-CoV-2 through the postpandemic period (14 April 2020)

> This model suggests that SARS-CoV-2 could proliferate at any time of year and would likely be in regular circulation with possible annual, biennial, or sporadic patterns (depending on immunity length) over the next 5 years.
>
> Excerpts from the discussion:
>
> "If immunity to SARS-CoV-2 wanes in the same manner as related coronaviruses, recurrent wintertime outbreaks are likely to occur in coming years. The total incidence of SARS-CoV-2 through 2025 will depend crucially on this duration of immunity and, to a lesser degree, on the amount of cross immunity that exists between HCoVs OC43/HKU1 and SARS-CoV-2."
>
> "One-time social distancing efforts may push the SARS-CoV-2 epidemic peak into the autumn, potentially exacerbating the load on critical care resources if there is increased wintertime transmissibility. Intermittent social distancing might maintain critical care demand within current thresholds, but widespread surveillance will be required to time the distancing measures correctly and avoid overshooting critical care capacity."
>
> "Less effective one-time distancing efforts may result in a prolonged single-peak epidemic, with the extent of strain on the healthcare system and the required duration of distancing depending on the effectiveness. Intermittent distancing may be required into 2022 unless critical care capacity is increased substantially or a treatment or vaccine becomes available."

MMWR: Characteristics of Health Care Personnel with COVID-19 — United States, February 12–April 9, 2020 (14 April 2020)

> "Of 9,282 U.S. COVID-19 cases reported among HCP [health care personnel], median age was 42 years, and 73% were female, reflecting these distributions among the HCP workforce. HCP patients reported contact with COVID-19 patients in health care, household, and community settings. Most HCP patients were not hospitalized; however, severe outcomes, including death, were reported among all age groups."

**In Brief**

*Ventilators & PPE*

General Motors has started mass production of ventilators, anticipating the first delivery to the US government later this month. Under a $489.4 million contract awarded by HHS, GM will make 30,000 ventilators by the end of August (AutoNews).

In follow up to a brief mention in the 31 March COVID-19 report, there is now a consortium for information on N95 decontamination and reuse, and includes guidelines, FAQs, and technical reports (N95Decon).

*Mental Health & Resilience*

Massachusetts General Hospital has developed and made available a 3-session video course to support frontline healthcare personnel working with COVID-19 patients (Mass Gen).

The National Academy of Medicine has a collection of resources to support the health and well-being of clinicians (NAM).

*Be Prepared*

If you need to know how to do end-of-life planning during the coronavirus pandemic, this Vox article outlines eight steps for making crucial financial and health care decisions for you and your loved ones (Vox).

The current toilet paper shortage is more complicated than hoarding, and there's not an easy fix (Marker). When toilet paper and baby wipes run out, there's always the bidet – which may be better for sewage systems and the environment, if you need incentive to switch (NYTimes).

*Countering Misinformation*

Encountering questionable news or information about COVID-19? Smithsonian Magazine has a step-by-step guide on how to vet news and guidance on what to do when you see misinformation shared by someone else (Smithsonian).

For a deeper dive in the literature, the University of Toronto library has developed an online module on discerning information sources, especially related to COVID-19; the module covers primary and secondary research, changes to peer review with fast publication, and preprint servers (UofT Lib).

*Pandemic in Pop Culture*

Art imitating life, or life imitating art? "Syllabus for the end of the world" – the essential books, movies, and other media about how to live in, and after, a pandemic (Vox).

**Looking Ahead**

Planned for upcoming reports: COVID-19 registries; special topic on ethics in pandemics; and any other submitted requests.

**References**


*Statistics*

Dept VA: U.S. Department of Veterans Affairs. COVID-19 National Summary. Link: https://www.accesstocare.va.gov/Healthcare/COVID19NationalSummary

JHU CSSE: Johns Hopkins Center for Systems Science and Engineering. Coronavirus COVID-19 Global Cases. Link: https://gisanddata.maps.arcgis.com/apps/opsdashboard/index.html

UW: University of Washington, Institute for Health Metrics and Evaluation. COVID-19 projections assuming full social distancing through May 2020 (01 April 2020). Link: https://covid19.healthdata.org/

VA DOH: Virginia Department of Health. COVID-19 in Virginia, updated daily. Link: http://www.vdh.virginia.gov/coronavirus/

VHHA: Virginia Hospital and Healthcare Association. Virginia Hospital COVID-19 Dashboard (updated daily) Link: https://www.vhha.com/communications/virginia-hospital-covid-19-data-dashboard/

*Evidence Summary: Invasive Versus Noninvasive Ventilation*

AARC: American Association for Respiratory Care. SARS CoV-2 guidance document (accessed 17 April 2020). Link: https://www.aarc.org/wp-content/uploads/2020/03/guidance-document-SARS-COVID19.pdf

AARC: Strickland SL, Rubin BK, Drescher GS, Haas CF, O'Malley CA, Volsko TA, Branson RD, Hess DR; American Association for Respiratory Care, Irving, Texas. AARC clinical practice guideline: effectiveness of nonpharmacologic airway clearance therapies in hospitalized patients. Respir Care. 2013 Dec;58(12):2187-93. doi: 10.4187/respcare.02925. Epub 2013 Nov 12. PubMed PMID: 24222709. Link: http://rc.rcjournal.com/content/58/12/2187/tab-pdf

Anesthesiology: Meng L, Qiu H, Wan L, Ai Y, Xue Z, Guo Q, Deshpande R, Zhang L, Meng J, Tong C, Liu H, Xiong L. Intubation and Ventilation amid the COVID-19 Outbreak: Wuhan's Experience. Anesthesiology. 2020 Mar 26. doi: 10.1097/ALN.0000000000003296. [Epub ahead of print] PubMed PMID: 32195705; PubMed Central PMCID: PMC7155908. Link: https://www.ncbi.nlm.nih.gov/pmc/articles/PMC7155908/

Ann Intensive Care: Wang K, Zhao W, Li J, Shu W, Duan J. The experience of high-flow nasal cannula in hospitalized patients with 2019 novel coronavirus-infected pneumonia in two hospitals of Chongqing, China. Ann Intensive Care. 2020 Mar 30;10(1):37. doi: 10.1186/s13613-020-00653-z. PubMed PMID: 32232685; PubMed Central PMCID: PMC7104710. Link: https://www.ncbi.nlm.nih.gov/pmc/articles/PMC7104710/

BMJ Open Respir Res: Griffiths MJD, McAuley DF, Perkins GD, Barrett N, Blackwood B, Boyle A, Chee N, Connolly B, Dark P, Finney S, Salam A, Silversides J, Tarmey N, Wise MP, Baudouin SV. Guidelines on the management of acute respiratory distress syndrome. BMJ Open Respir Res. 2019 May 24;6(1):e000420. doi: 10.1136/bmjresp-2019-000420. eCollection 2019. PubMed PMID: 31258917; PubMed Central PMCID: PMC6561387. Link: https://www.ncbi.nlm.nih.gov/pmc/articles/PMC6561387/

COVID-19 Protocols: Brigham and Women's Hospital COVID-19 clinical guidelines – respiratory and pulmonary (last updated 15 April 2020). Link: https://covidprotocols.org/protocols/03-respiratory-and-pulmonology/

ESPNIC: European Society of Paediatric and Neonatal Intensive Care. Practice recommendations for managing children with proven or suspected COVID-19 (accessed 16 April 2020). Link: https://espnic-online.org/News/Latest-News/Practice-recommendations-for-managing-children-with-proven-or-suspected-COVID-19

Intensive Care Med: Bouadma L, Lescure FX, Lucet JC, Yazdanpanah Y, Timsit JF. Severe SARS-CoV-2 infections: practical considerations and management strategy for intensivists. Intensive Care Med. 2020 Apr;46(4):579-582. doi: 10.1007/s00134-020-05967-x. Epub 2020 Feb 26. PubMed PMID: 32103284; PubMed Central PMCID: PMC7079839. Link: https://link.springer.com/article/10.1007%2Fs00134-020-05967-x

Intensive Crit Care Nurs: Lucchini A, Giani M, Isgrò S, Rona R, Foti G. The "helmet bundle" in COVID-19 patients undergoing non invasive ventilation. Intensive Crit Care Nurs. 2020 Apr 2:102859. doi: 10.1016/j.iccn.2020.102859. [Epub ahead of print] PubMed PMID: 32249028. Link: https://www.sciencedirect.com/science/article/pii/S0964339720300628

Lancet Respir Med: Ñamendys-Silva SA. Respiratory support for patients with COVID-19 infection. Lancet Respir Med. 2020 Apr;8(4):e18. doi: 10.1016/S2213-2600(20)30110-7. Epub 2020 Mar 5. PubMed PMID: 32145829; PubMed Central PMCID: PMC7129706. Link: https://www.thelancet.com/journals/lanres/article/PIIS2213-2600(20)30110-7/fulltext

Mass Gen: Massachusetts General Hospital. Critical Care Guidance (05 April 2020). Link: https://www.massgeneral.org/assets/MGH/pdf/news/coronavirus/treatment-guidance-for-critically-ill-patients-with-COVID-19.pdf

Mass Gen: Massachusetts General Hospital. Prone Positioning Protocol for Intubated Patients (08 April 2020). Link: https://www.massgeneral.org/assets/MGH/pdf/news/coronavirus/prone-positioning-protocol.pdf

Mass Gen: Massachusetts General Hospital. Prone Positioning Protocol for Non-Intubated Patients (02 April 2020). Link: https://www.massgeneral.org/assets/MGH/pdf/news/coronavirus/prone-positioning-protocol-for-non-intubated-patients.pdf

Pharmaceutics: McGrath JA, O'Toole C, Bennett G, Joyce M, Byrne MA, MacLoughlin R. Investigation of Fugitive Aerosols Released into the Environment during High-Flow Therapy. Pharmaceutics. 2019 Jun 1;11(6). pii: E254. doi: 10.3390/pharmaceutics11060254. PubMed PMID: 31159408; PubMed Central PMCID: PMC6630289. Link: https://www.mdpi.com/1999-4923/11/6/254/htm

Respirology: Yam LY, Chen RC, Zhong NS. SARS: ventilatory and intensive care. Respirology. 2003 Nov;8 Suppl:S31-5. Review. PubMed PMID: 15018131. Link: https://onlinelibrary.wiley.com/doi/full/10.1046/j.1440-1843.2003.00521.x

UN: University of Nebraska. COVID-19 ARDS Ventilator PEEP Titration Protocol. Link: https://www.nebraskamed.com/sites/default/files/documents/covid-19/ards-ventilator-peep-titration-protocol.pdf?date=03242020

UN: University of Nebraska. COVID19 Proning Protocol – "PRONOCOL" Link: https://www.nebraskamed.com/sites/default/files/documents/covid-19/proning-protocol.pdf

UW: University of Washington Medicine. COVID-19 Resource Site (accessed 16 April 2020). Link: https://covid-19.uwmedicine.org/Pages/default.aspx

UW: University of Washington Medicine. High-Flow Nasal Cannula in the Management of Patients with COVID-19 (03 April 2020). Link: https://covid-19.uwmedicine.org/Screening%20and%20Testing%20Algorithms/High-Flow%20Nasal%20Cannula%20in%20the%20Management%20of%20Patients%20with%20COVID-19.pdf

*Recent Literature*

Am J Respir Crit Care Med: Griffin KM, Karas MG, Ivascu NS, Lief L. Hospital Preparedness for COVID-19: A Practical Guide from a Critical Care Perspective. Am J Respir Crit Care Med. 2020 Apr 16. doi: 10.1164/rccm.202004-1037CP. [Epub ahead of print] PubMed PMID: 32298146. Link: https://www.atsjournals.org/doi/pdf/10.1164/rccm.202004-1037CP

ASPR: Assistant Secretary for Preparedness and Response. COVID-19 Hospital Resource Package (accessed 16 April 2020). Link: https://files.asprtracie.hhs.gov/documents/covid-19-hospital-resource-package-document.pdf See also: https://asprtracie.hhs.gov/COVID-19

JAMA: Kim D, Quinn J, Pinsky B, Shah NH, Brown I. Rates of Co-infection Between SARS-CoV-2 and Other Respiratory Pathogens. JAMA. 2020 Apr 15. doi: 10.1001/jama.2020.6266. Epub

ahead of print. PMID: 32293646. Link: https://jamanetwork.com/journals/jama/fullarticle/2764787

JAMA: Marcotte LM, Liao JM. Incorporating Test Characteristics Into SARS-CoV-2 Testing Policy—Sense and Sensitivity (published online 15 April 2020). JAMA Health Forum. Link: https://jamanetwork.com/channels/health-forum/fullarticle/2764750

Lancet Psychiatry: Holmes EA, O'Connor RC, Perry VH, et al. Multidisciplinary research priorities for the COVID-19 pandemic: a call for action for mental health science (published 15 April 2020). Lancet Psychiatry. DOI: https://doi.org/10.1016/S2215-0366(20)30168-1 Link: https://www.thelancet.com/journals/lanpsy/article/PIIS2215-0366(20)30168-1/fulltext

MMWR: CDC COVID-19 Response Team. Characteristics of Health Care Personnel with COVID-19 — United States, February 12–April 9, 2020. MMWR Morb Mortal Wkly Rep. ePub: 14 April 2020. DOI: http://dx.doi.org/10.15585/mmwr.mm6915e6. Link: https://www.cdc.gov/mmwr/volumes/69/wr/mm6915e6.htm

Nature: He X, Lau EHY, Wu P, et al. Temporal dynamics in viral shedding and transmissibility of COVID-19 (published 15 April 2020). Link: https://www.nature.com/articles/s41591-020-0869-5

Science: Kissler SM, Tedijanto C, Goldstein E, Grad YH, Lipsitch M. Projecting the transmission dynamics of SARS-CoV-2 through the postpandemic period (14 April 2020). Science. Link: https://science.sciencemag.org/content/early/2020/04/14/science.abb5793.full

*In Brief*

AutoNews: GM begins mass production of ventilators for U.S. government (14 April 2020). Link: https://www.autonews.com/manufacturing/gm-begins-mass-production-ventilators-us-government

Marker: Will Oremus. What Everyone's Getting Wrong About the Toilet Paper Shortage (02 April 2020). Link: https://marker.medium.com/what-everyones-getting-wrong-about-the-toilet-paper-shortage-c812e1358fe0

Mass Gen: Massachusetts General Hospital Resilience and Prevention Program. Resilience Training for Healthcare Workers (accessed 17 April 2020). Link: https://www.resilienceandprevention.com/healthcare-providers

N95Decon: A scientific consortium for data-driven study of N95 filtering facepiece respirator decontamination (last update 05 April 2020). Link: https://www.n95decon.org/

NAM: National Academy of Medicine. Resources to Support the Health and Well-Being of Clinicians During COVID-19 (accessed 17 April 2020). Link: https://nam.edu/initiatives/clinician-resilience-and-well-being/clinician-well-being-resources-during-covid-19/

NYTimes: Sasha von Oldershausen. Is It Time for Americans to Embrace the Bidet? (01 April 2020). Link: https://www.nytimes.com/2020/04/01/style/toilet-paper-shortage-bidet-coronavirus-wipes.html

Smithsonian: Lila Thulin. How to avoid misinformation about COVID-19 (09 April 2020). Link: https://www.smithsonianmag.com/science-nature/how-avoid-misinformation-about-covid-19-180974615/

UofT Lib: Gerstein Science Information Centre. Navigating the COVID-19 Evidence Landscape (last updated 09 April 2020). Link: https://rise.articulate.com/share/soW5Pvyk3T4Ib-P4A7gS6AFqyOxsB2Eo#/

Vox: Ann Neumann. How to do end-of-life planning during the coronavirus pandemic (15 April 2020). Link: https://www.vox.com/2020/4/15/21220975/coronavirus-end-of-life-planning

Vox: Alissa Wilkinson. A syllabus for the end of the world (03 April 2020). Link: https://www.vox.com/culture/2020/4/15/21193679/coronavirus-pandemic-war-metaphor-ecology-microbiome